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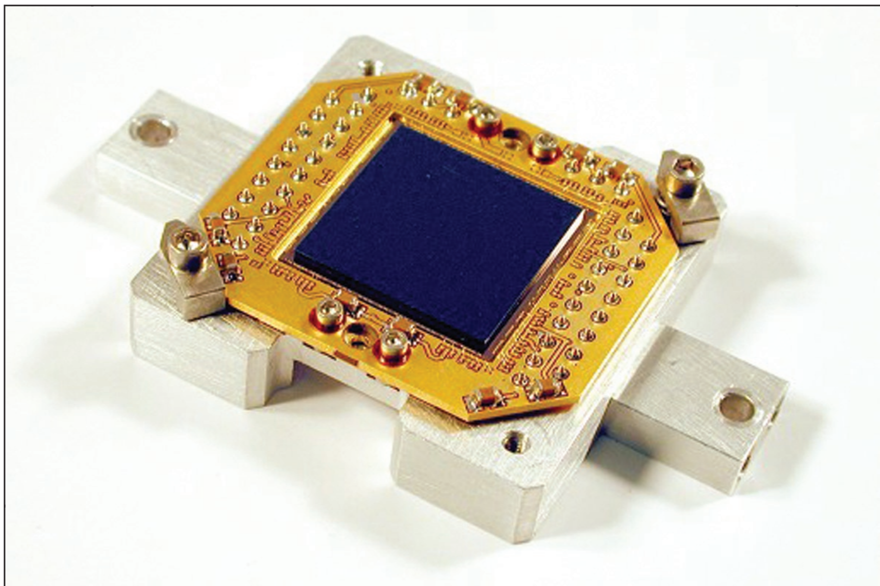
Science and Technology for Tomorrow's Air and Space Force

Success Story

ADVANCED DEVELOPMENT OF HIGH-PERFORMANCE LWIR FPAS FOR SPACE-BASED GLOBAL MISSILE DEFENSE



Infrared focal plane arrays (IRFPAs) are critical components to space sensor payloads because they enable detection, tracking, and discrimination of long-range tactical and strategic missiles. The research and development effort of the Materials and Manufacturing Directorate and Rockwell Scientific Corporation (RSC) improves the performance of the arrays and ensures both timely delivery and high-quality products at an affordable cost. Continued success could lead to significant reductions in both payload costs and the number of satellites required for global coverage.

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Accomplishment

Scientists at the directorate and RSC have made significant advancements in the development of high-performance, long-wavelength infrared detectors needed to produce IRFPAs to build a space-based global defense system. The directorate completed fabrication of the first focal plane array (FPA) demonstration lot and used screening techniques and best growth techniques to fabricate and evaluate FPAs. A detector array (SCM1250-64) had extremely high performance against space test criteria. These performance results are state of the art for long-wavelength infrared (LWIR), low-background detection applications and demonstrate the success of the processes developed to date.

Background

IRFPAs are critical components to the space sensor payload. Researchers at the directorate and RSC have an ongoing research and development effort to improve practices to fabricate mercury cadmium selenide LWIR FPAs. Researchers designed this effort to create a thorough understanding of the limiting factors of the infrared materials, develop innovative techniques to overcome those factors that limit performance, and demonstrate cost- effective screening procedures that reduce yield losses at test, thus shortening the fabrication/test time and costs.

The directorate made significant progress during the first year of this program by developing compositional control, wafer-screening techniques including infrared, dark field, and Normarski contrast microscopy as well as laser profilometry. The directorate and RSC also employed an automated defect counting techniques with automated frame-grabber software.

These techniques demonstrate that the substrate precipitates are the primary source of voids and microdefects in molecular beam epitaxial mercury cadmium telluride layers that limit their performance. Researchers developed and implemented routine non-destructive wafer mapping of composition and layer thickness to improve yield in detector cutoff.

Materials and Manufacturing
Emerging Technologies

Additional information

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